What is claimed is:

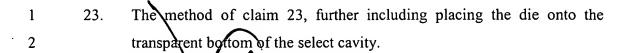


An apparatus comprising:

- a transparent plate with an upper surface; and
- a plurality of spaced apart fiducials formed on the upper surface at locations
- 1 2. The apparatus of claim 1, wherein the transparent plate is glass.
- 1 3. The apparatus of claim 2, wherein the glass is quartz.
- 1 4. The apparatus of claim 1, wherein the fiducials are formed by electron-beam
- 2 lithography.
- 1 5. The apparatus of claim 1, wherein the spaced apart fiducials have a
- 2 placement accuracy equal to or less than 2 microns, 3 sigma.
- 1 6. An apparatus comprising:
- a transparent plate having fiducials on a surface, the transparent plate
- adapted to be positioned beneath a panel having transparent segments so that a die
- 4 suspended above the panel and having a die alignment mark can be aligned and
- 5 positioned relative to at least one of the fiducials.
- 1 7. The apparatus of claim 6, wherein the transparent plate is made of glass.
- 1 8. The apparatus of claim 7, wherein the glass is quartz.
- 1 9. The apparatus of claim 6, wherein the fiducials are chrome.

1	0. An apparatus comprising:
2	a movable pick-up head capable of holding, positioning and releasing a die,
3	the die having an alignment mark;
4	\setminus a panel support member adapted to movably support a panel in a panel
5	support plane, the panel having upper and lower surfaces and an array of cavities
6	each open at the upper surface and each having a transparent bottom;
7	a transparent plate with fiducials arranged at locations corresponding to
8	desired die locations, the transparent plate arranged adjacent the panel support plane
9	opposite the movable pick-up head; and
10	an optical vision system adapted to image at least one fiducial and generate
11	an electrical signal corresponding to the position of the at least one fiducial.
1	11. The apparatus of claim 10, further including a controller electrically
2	connected to the pick-up head and the optical vision system, the controller adapted
3	to control the movement of the pick-up head in response to the electrical signal.
1	12. The apparatus of claim 10, wherein the transparent plate is made of glass.
1	13. The apparatus of claim 11, wherein the glass is quartz.
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1	14. The apparatus of claim 10 wherein the fiducials are formed by electron-
2	beam lithography.
1	15. A method comprising:
2	providing a panel with a plurality of cavities, each cavity including an
3	opening to a panel upper surface and a transparent bottom at a panel lower surface;
4	arranging adjacent the panel lower surface a transparent plate having an
5	upper surface with a plurality of fiducials formed thereon, with one fiducial aligned
6	with the each cavity transparent bottom and serving as a local fiducial; and
7	imaging the local fiducial to align the die to the cavity.
′	maging the local fiducial to angli the die to the cavity.

- 1 16 The method of claim 15, further including determining a position of the die
- 2 relative to the local fiducial based on said imaging.
- 1 17. The method of claim 16, including generating an electrical signal
- 2 corresponding to the die position relative to the local fiducial.
- 1 18. The method of claim 17, further including aligning the die with the local
- 2 fiducial.
- 1 19. The method of claim 18, further including:
- 2 inserting the die into the opening of the cavity associated with the local
- 3 fiducial; and
- 4 contacting the die to the transparent bottom.
- 1 20. The method of claim 15, including forming the fiducials using electron-
- 2 beam lithography.
- 1 21. A method comprising:
- 2 forming fiducials on an upper surface of a transparent plate;
- arranging the transparent plate relative to a panel having multiple cavities
- 4 formed in a panel upper surface, with each cavity having a transparent bottom, said
- 5 arranging including aligning each fiducial beneath a corresponding one of the
- 6 multiple cavities; and
- 7 imaging a select one of the fiducials corresponding to a select one of the
- 8 cavities to establish a die position relative to the select one of the cavities.
- 1 22. The method of claim 21, including making the transparent bottom adhesive.
- 1 23. The method of claim 21, including aligning the die alignment mark to the
- 2 select fiducial.



24. The method of claim 21, including imaging the die alignment mark through the transparent bottom.



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